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Non technical summary Precise knowledge of the effect of a variety of individual and macro variables on the distribution of unemployment duration is useful for many reasons. From a practical viewpoint, it can be used to design policy measures in order to prevent long-term unemployment and from a scientific viewpoint it helps to reduce the risk of misspecification for parametric duration models. With this paper, we examine the effects of a variety of micro and macro variables on the distribution of unemployment duration of the 26-41 aged workforce using register data from West Germany during the period 1981 to 1997.

For the first time quantile regressions are applied to German unemployment data. We use quantile regression methods because they are robust with respect to the error distribution. Moreover, in contrast to mean value methods and many typical duration models, they allow us to examine whether the effect of a regressor varies and changes the sign over the quantiles of the unemployment duration distribution. A violation of the proportionality property would induce that the proportional hazard specification is incorrect. Our estimation results show that this is indeed the case for some regressors. A duration model that accounts for unobserved heterogeneity or allows for time-varying regressors is therefore indispensable.

We find that the individual unemployment history had a stronger effect on the unemployment duration than sociodemographic variables and the macroeconomic situation. Individuals who had been recently unemployed before and who were recalled by the same employer exhibit significantly shorter unemployment duration. Work history variables therefore explain quite well differences in the probability of becoming long-term unemployed. Interestingly, a lot of working experience without periods of unemployment increases the probability of long-term unemployment.

Although the unemployment rate has doubled in the observed period, we only found relatively weak effects of the macroeconomic situation. Another interesting finding is that the unemployment duration of females has shortened during the period under consideration. This may be attributed to the introduction of parental leave benefits in 1986. In the 1980s, married females have had the longest unemployment duration.

Censored Quantile Regressions and the Length of Unemployment Periods in West Germany

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Abstract

We apply censored quantile regressions to representative German register data with more than 91,000 observations in order to determine crucial factors that influence the distribution of unemployment duration in West Germany during the 1980s and 1990s. We find that the effect of some regressors varies and has different sign depending on the quantiles of the unemployment duration distribution – a violation of the classical proportional hazard assumption which is very popular in unemployment duration analysis. We also find that variables reflecting the (un-)employment history of an individual such as the length of tenure, recall to the same employer in the past, recent unemployment and the position in the population income distribution before unemployment have the strongest effects on unemployment duration. We conclude that work history variables are most suitable in characterizing the job search behavior of an individual. The macroeconomic environment and the educational degree seem to have a limited effect only.

Keywords: censored quantile regression, unemployment duration, register data
JEL: C24, J64

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1 Introduction

Precise knowledge of the effect of a variety of individual and macro variables on the distribution of unemployment duration is useful for many reasons. From a practical viewpoint, it can be used to design policy measures in order to prevent long-term unemployment and from a scientific viewpoint it helps to reduce the risk of misspecification for parametric duration models. With this paper, we examine the effects of a variety of micro and macro variables on the distribution of unemployment duration using register data from West Germany during the period 1981 to 1997. For the econometric analysis, we use censored quantile regressions suggested by Koenker and Bilias (2001) as a flexible approach to get a comprehensive insight into the determinants of the distribution of unemployment duration.

So far, a large number of papers has been published on unemployment duration analysis for West Germany. Most of these papers analyze the effect of the German unemployment compensation system on the duration of unemployment. In particular, the reform of this system during the 1980s was subject to many analyses. During this reform, the entitlement to unemployment compensation was extended for the older unemployed (aged 42 and older), see e.g. Hunt (1995), Hujer and Schneider (1995), and recently Fitzenberger and Wilke (2004) for detailed analyses. The results in most of these papers (except for Fitzenberger and Wilke, 2004) are affected by the early retirement of elderly workers. The estimation of the effect of the level of unemployment compensation is systematically affected when a sample is used which includes unemployed who are in fact early retired and who have for this reason a zero probability of reentering employment. For a comprehensive study about early retirement issue in West Germany see Fitzenberger and Wilke (2004).

In contrast, in the present paper, it is not our purpose to evaluate a specific policy measure or reform, but to obtain a better understanding of the determinants of the distribution of unemployment duration in general. Therefore, we restrict our analysis to the unemployed aged 26 to 41, supposing that the latter are not affected by the labor market reforms undertaken in West Germany in the period considered. Moreover, early retirement will not affect the results in the present paper. In addition, the effect of the unemployment compensation system is not explicitly investigated in this paper because of a lack of observability in the data. However, we indirectly control for this by using variables computed from the work history of the individuals.

Most of the papers to date on unemployment duration analysis for West Germany are based on the German Socio-Economic Panel (GSOEP), which is survey data. Unemployment duration data drawn from surveys have several drawbacks compared to register data. This

is due to the limited sample size, the imperfect recall of the interviewed individuals and due to misleading replies. See for example Schräpler (2002) who analyzes non-response behavior. Therefore, in the present paper, we use German register data to circumvent these limitations.

In addition, the econometric model used in the present paper is different from the papers to date on unemployment duration analysis for West Germany. In the majority of the papers to date, single spell proportional hazard models have been used. It is well known that estimation results of single spell proportional hazard models that account for unobserved heterogeneity (mixed proportional hazard model) are often unstable, see van den Berg (2001) for a survey. At the same time, duration models that do not account for unobserved heterogeneity are expected to be inconsistent. For this reason and due to the drawbacks of the GSOEP, we assume that the results of the studies about Germany are unstable. Only few contributions work with German register data and do not apply proportional hazard models or related models, e.g. Fitzenberger and Wilke (2004) and Wilke (2004).

For the first time quantile regressions are applied to German unemployment data. We use quantile regression methods because they are robust with respect to the error distribution. Moreover, in contrast to mean value methods and many typical duration models [1], they allow us to examine whether the effect of a regressor varies over the quantiles of the unemployment duration distribution. Wilke (2004) explores whether there are disproportional changes over the duration time and over the calendar time and he finds some indications for this since in some cases the survivor functions cross. A violation of the proportionality property would induce that the proportional hazard specification imposes a severe restriction on the nature of the effect of covariates. Our estimation results show that this is indeed the case for some regressors since the estimated coefficients changes signs over the quantiles. A duration model that accounts for unobserved heterogeneity or allows for time-varying regressors is therefore indispensable. Using quantile regression to analyze survival times offers an valuable complement to traditional proportional hazard modelling.

The structure of the paper is as follows: Section 2 describes the data and the German unemployment compensation system. Section 3 presents the econometric model and section 4 the estimation results. Section 5 concludes.

[1] We do not mean duration models with time varying covariates.

2 Data and Institutions

The analysis is based on German register data containing spell information of employment and un-/nonemployment trajectories of about 500,000 individuals from West Germany. [2] More specifically, we use the IAB employment subsample 1981-1997 -regional file- [3] for our analysis, from which we draw a specific subsample described later. The IAB employment subsample is representative with respect to the socially insured working population. However, it does not contain periods of self-employment and of employment as life-time civil servant (Beamte). The data provides daily information about the starting and the ending points of socially secured employment as well as unemployment provided that any form of unemployment compensation from the federal employment office (BA) is received. In Germany, unemployment compensation consists of unemployment benefits (Arbeitslosengeld, ALG), unemployment assistance (Arbeitslosenhilfe, ALHi) and maintenance payments during further training (Unterhaltsgeld, UHG). During the years 1981 to 1997, about 65% to 75 % of all registered unemployed draw ALG or ALHi.

An employee qualifies for unemployment benefits after having been in socially secured employment for at least 12 months during the past three years. The monthly amount of unemployment benefits is 60% to 68% of the previous net monthly wage. After having exhausted the maximum entitlements for unemployment benefits or in case of not being entitled, an unemployed can draw unemployment assistance, which is means-tested and in case of entitlement also related to the previous net wage (53% - 58% in the period under consideration). Unemployment assistance can be provided for an unlimited period but the entitlements are regularly checked. If an unemployed participates in the meantime in further training measures he receives specific payments (UHG) during this period. The payment scheme for UHG is related to the one of ALG. For a more detailed description of the German unemployment compensation system see Hunt (1995) or Plaßmann (2002). However, there is no information about the amount of unemployment compensation received in the data. We only have the more general information if unemployment compensation is drawn or not.

We restrict our analysis to unemployment spells starting between 1981 and 1995 of individuals aged 26 to 41 during this period. This restriction is chosen in order to obtain a quite homogeneous subsample: all individuals have 12 months maximum entitlement length for unemployment benefits, they are too young to be affected by the early retirement issue

[2] In this analysis an individual is said to be West German if the last employment period before unemployment was in West Germany.

[3] For a general description of the data see Bender et al. (2000).

(Fitzenberger and Wilke, 2004) and too old to get special treatment against youth unemployment.

Registered unemployment is not recorded in the IAB employment subsample and therefore one cannot precisely distinguish between unemployment and nonemployment periods because unemployment periods without receipt of unemployment compensation from the BA are not observed. For this reason, Fitzenberger and Wilke (2004) introduce the definition "Nonemployment", which is adopted for our analysis. Nonemployment is any period after an employment period, in which an individual is not (socially secured) employed and receives at least for one day some kind of unemployment compensation from the federal employment office. The latter condition ensures that at least a part of each nonemployment period overlaps with unemployment and rules out purely out-of-the-labor-market periods. In fact, the same data is used as in Wilke (2004), but he considers only four years (1981, 1985, 1990 and 1995). Under the restrictions mentioned above, our sample contains 91,035 observations. For descriptive statistics of the variables used, see Table 5.

Using this definition of nonemployment, unemployed which are not entitled for compensation payments from the BA, are not considered. However, out-of-the-labor-market-periods may be included for the analysis. Conditioning on employment before unemployment and on the receipt of transfer payments from the BA, we have a pre-selection of unemployment periods. Moreover, it should be noted that for some groups, the length of unemployment periods is systematically upward biased. This is in particular the case for individuals who are likely to drop out of the labor force for some period, e.g. females in motherhood. Furthermore, there are right-censored nonemployment spells in the data, if the last observed spell of an individual is the receipt of unemployment compensation. We account for right censoring by using censored quantile regressions, a method which will be described in the following section.

3 Econometric Model

Quantile regression (QR) is gradually evolving into a comprehensive approach to the statistical analysis of linear and nonlinear response models for conditional quantile functions. Just as classical linear regression methods based on minimizing sums of squared residuals allow one to estimate a general class of models for conditional mean functions, quantile regression methods offer a mechanism for estimating models for the conditional median function and the full range of other conditional quantile functions. Quantile regression is capable of providing a more complete statistical analysis of the stochastic relationships among random

variables. In contrast to mean value methods and standard proportional hazard models such as the Cox model and the Accelerated Failure Time (AFT) model QR allow us to obtain different effects of the covariates at different points of the conditional unemployment duration distribution. The advantages of QR based duration analysis are summarized in Koenker and Geling (2001). Koenker and Bilias (2001) and Koenker and Xiao (2002) discuss applications to unemployment duration models and some general problems of inference based on the quantile regression process.

3.1 Quantile regression model

The quantile regression model, first introduced by Koenker and Bassett (1978), can be viewed as a location model. Let y denote the unemployment duration. We model the conditional quantile functions of the logarithm of unemployment duration as linear in the observed covariates, x,

$$lny_i = x_i'\beta^\theta + u_i^\theta \tag{1}$$

with

$$Quant_\theta(lny_i|x_i) = x_i'\beta^\theta, i = 1, ..., k, \tag{2}$$

where x_i is a $k \times 1$ vector of covariates with $x_i \equiv 1$ for all i and β_θ is a $k \times 1$ parameter vector. The term $Quant_\theta(lny_i|x_i)$ denotes the θth conditional quantile of lny given x. Here u is defined by $u_\theta \equiv lny - x'\beta_\theta$, so that $Quant_\theta(u_\theta|x) = 0$, or alternatively $F_{u_\theta}(0|x) = \theta$. Koenker and Bilias (2001) describe the link between quantile regression and the transformation model and stress a general formulation of treatment effects introduced by Lehmann (1974). The simplest formulation of quantile regression is the two-sample treatment-control model,

$$Quant_\theta(lny|x) = \beta_1^\theta + \beta_2^\theta x \tag{3}$$

with $x = 1$ for treatment and $x = 0$ for the control group. The QR framework is flexible enough to allow for, say, $\beta_2^{0.2} > 0$ but $\beta_2^{0.8} = 0$ - the treatment being effective on left tail but not on the right tail of the duration distribution. If the treatment is continuous, as "age", for example, we assume that the treatment effect, β_2^θ, of changing x from x_0 to $x_0 + 1$ is the same as the treatment effect of changing x from x_1 to $x_1 + 1$.

Another important property of the quantile regression model is that, for any monotone function, $h(\cdot)$,

$$Quant_\theta(h(y)|x) = h(Quant_\theta(y|x)). \tag{4}$$

This equivariance to monotone transformations of the quantile regression model allows us to write, in particular, the family of conditional quantile functions for the untransformed

duration y as

$$Quant_\theta(y_i|x_i) = exp(x_i'\beta_\theta). \tag{5}$$

3.2 Censored quantile regression - Estimation

When there is no censoring, the quantile regression coefficients, β_θ, can be estimated for given $\theta \in (0,1)$ by the methods introduced by Koenker and Basset (1978). Powell (1984, 1986) developed censored quantile regressions (CQR's) as a robust extension to the censored regression problem (for a recent discussion of censored quantile regression see Fitzenberger, 1997). Consider the sample (lny_i, x_i, yc_i), $i = 1, ..., k$, where yc_i denotes the upper threshold for lny_i, i.e. $lny_i \leq yc_i$ ($yc_i = lny_i$ when an observation is censored and $yc_i = \infty$ when it is not censored) for all i. The quantile regression estimator of β_θ is a solution to

$$\frac{1}{N}\sum_{i=1}^{N} \rho_\theta(lny_i - min(x_i'\beta^\theta, yc_i)) \tag{6}$$

with,

$$\rho_\theta(u) = \begin{cases} \theta \cdot |u| & \text{for } u \geq 0 \\ (1-\theta) \cdot |u| & \text{for } u < 0. \end{cases} \tag{7}$$

The min operator censors $x_i'\beta$ at the larger threshold yc_i from above, i.e. the expression becomes $x_i'\beta$ if $x_i'\beta \leq yc_i$ and it becomes yc_i if $x_i'\beta$ is larger than yc_i. Estimation is performed iteratively using the (censored) LAD procedure in TSP 4.5. For the estimation of standard errors for the individual coefficients we use the bootstrap method. 50 resamples[4] are drawn by i.i.d. resampling of the entire vector of the logarithm of unemployment duration, regressor and censoring values, and the standard deviation of the coefficient estimates across the resamples is taken as the bootstrap standard error estimate.

3.3 Marginal effects

According to Machado and Mata (2000), the population quantile regression parameter in our analysis is defined as

$$\gamma_j(\theta, \overline{x}) = \partial Quant_\theta(y|\overline{x})/\partial x_j = exp(\overline{x}'\beta^\theta)\beta_j^\theta, \quad j = 1, ..., k, \tag{8}$$

where $\overline{x}$ denotes the vector of the regressors' sample means and y is untransformed unemployment duration. The marginal effect of each regressor, say of "tenure", measures the

[4]The estimation of standard errors with 50 repetitions took already 3 weeks. Since we use 91,000 observations, we assume that this gives quite reliable estimates for the standard errors.

change in the unemployment duration which, *ceteris paribus*, would keep an unemployment duration in the same quantile when "tenure" increases by a marginal unit.

The (Cox-) proportional hazard modell does not provide a direct analog of the regression quantile, β_θ, since conditional quantiles under the Cox model are not linear in x. However, Koenker and Geling (2001) suggest one local measure of the marginal effects of various covariates in the Cox model on the conditional quantile at θ. The quantile function for the survival time T in the Cox model is $Q_\theta(T|x) = S_0^{-1}((1-\theta)^{1/\eta(x)})$, where $\eta(x) = e^{-x'\beta}$ and $S_0(t)$ denotes the baseline survival function. Thus the marginal effects in the Cox model is

$$\partial Q_\theta(T|x)/\partial x_j = \frac{(1-\theta)log(1-\theta)\eta(x)}{S_0'(Q_\theta(T|x))}\beta_j, \quad j = 1, ..., k.$$

Because the baseline hazard rate $\lambda_0(t) \geq 0$, the sign of the coefficient β_j in the proportional hazard model determines the sign of the marginal effect over the entire distribution. Therefore, a proportional hazard model does not permit behavior where the sign of the effect may change with the size of the response.

4 Estimation Results

Our model includes the following regressors:

- Indicators for three periods, 1983 to 1987, 1988 to 1991 and 1992 to 1995, with reference period 1981 to 1982.
- The annual unemployment rate.
- Indicator for whether the person became unemployed during the winter time (November to February).
- Indicators for female, married, married female in the period 1988 to 1995
- Indicator for "no German citizenship".
- Indicators for apprenticeship and university degree and no apprenticeship in the period 1992 to 1995.
- Person's age enters the model as a quadratic.
- 5 quintiles ($0-20\%$, $20-40\%$, $40-60\%$, $60-80\%$, $80-100\%$) of the location of the previous wage in the population income distribution.

- The tenure (in days) in the last job before unemployment.
- Indicator for whether the person received any form of unemployment compensation (ALG, ALHi, UHG) within the last year before becoming unemployed (LED-spell).
- Indicator for whether the person was recalled by the same employer in the previous unemployment duration.
- Indicators for agricultural and technical profession.
- Indicators for employee and part-time worker.

In Figure 1 we present a concise visual representation of the results from the estimation of the model. Each plot depicts one coefficient in the quantile regression model. The solid line represents the point estimates, $\{\beta_j^\theta, j = 1, ..., 25\}$, with two dashed lines representing a 90% confidence interval for this coefficient. In the first panel of the figure the intercept of the model may be interpreted as the estimated conditional quantile function of the log unemployment durations of the control sample and all the other coefficients are simply location and scale shifts of this function. After the log transformation of durations, a location-scale shift would imply that the covariate exerts a time-varying percentage change in the durations. In the following we focus on some main effects on the macro and on the micro level.

4.1 Calendar time and Macroeconomic Situation

Year and unemployment rate During the years 1981 to 1982, the German economy was characterized by a high, but stable GDP growth rate and a relatively low, but sharply rising unemployment rate. In the period 1983 to 1987, the German unemployment rate remained at a constant high level of about 9%, whereas the GDP growth rate was comparable to that of the years 1981-1982. During the years 1988-1991, the German reunification took place, bringing about an economic boom. Hence, the unemployment rate was quite low and there was a high GDP growth rate. In contrast, the German economy during the years 1992-1995 was characterized by a relatively high unemployment rate induced by an economic recession.

In the estimation results the period 1983 to 1987 is associated with a quite uniform effect over the whole range of the distribution of about 93% ($= e^{-0.07}$). Beyond this period the negative effects become stronger in the lower tail and then gradually return to a null effect (in the last period 1992 to 1995) in the upper tail of the distribution. The annual unemployment rate when a person became unemployed is considerably more interesting; it exerts a estimated detrimental effect at the lower quantiles. However, beyond quantile

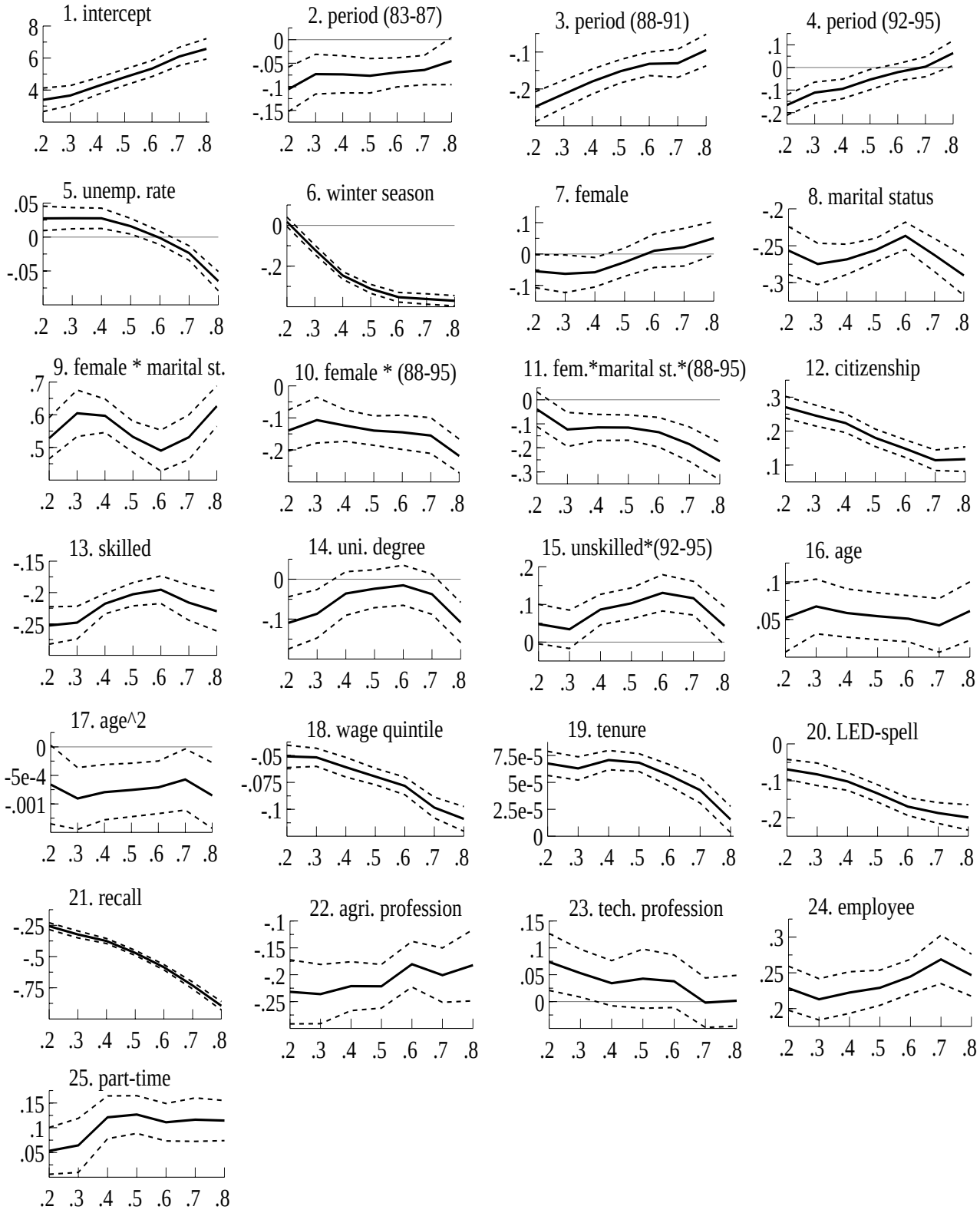


Figure 1: Estimated quantile regression coefficients $\beta_j^\theta, j = 1, ..., 25$, with 90% bootstrap confidence bands for quantile $\theta = 0.2, 0.3, ..., 0.8$

$\theta = 0.6$, it becomes a significant force for early reemployment at the higher quantiles. The joint influence of the annual unemployment rate and the period indicators could be measured with the estimated coefficients, given by $exp(\beta^{\theta}_{year} + unemp. * \beta^{\theta}_{unemp.})$, where *unemp.* denotes unemployment rate and *year* denotes period indicators.

Table 1 presents the relative combined effect with respect to the macro economic situation for the selected years, 1985, 1990 and 1995. The year 1981 is chosen as a reference category. In 1990, the good general economic situation led to shorter unemployment duration in all quantiles. It is interesting to note that the unemployment duration in 1995 tended to be weakly lower than in 1981, although the unemployment rate had risen sharply in the meantime. We observe that there is an effect of the business cycle on the length of unemployment duration, particularly at the lower quantiles. But similar to Wilke (2004) we do not observe that a doubling in the unemployment rate led to a shift in the distribution of unemployment duration to the right for the population under consideration.

Table 1: Relative effect of the calendar time relative to 1981.

Year	$\theta = 0.2$	$\theta = 0.5$	$\theta = 0.8$	Unemployment Rate	GDP Growth Rate
1981	100%	100%	100%	4.8%	0.1%
1985	99%	99%	78%	8.1%	2.2%
1990	81%	88%	85%	5.9%	5.7%
1995	93%	102%	87%*	8.2%	1.7%**

* read this with caution due to the censoring of the available data at the end of 1997

** caution: GDP growth rate for East and West Germany (Gesamtdeutschland)

Winter-season In general, the duration of unemployment is shorter for individuals who become unemployed in winter. This effect is stronger at the higher quantiles of the distribution. This can be explained by the fact that the proportion of long-term unemployed is smaller for those who become unemployed during the winter time. This coincides with the fact that by definition of seasonal unemployment a larger fraction is reemployed soon.

4.2 Sociodemographic factors

Gender and marital status The estimated coefficient for female appears increasing across the horizontal line, but barely achieving 10% significance for this effect. Married persons are 21% ($= 1 - e^{-0.24}$) to 25% ($= 1 - e^{-0.29}$) quicker than unmarried persons to exit unemployment. The effect of married women is highly significant positive.

Table 2: Effect of gender and marital status

	$\theta = 0.2$	$\theta = 0.5$	$\theta = 0.8$
unmarried men	100%	100%	100%
married men ($= exp(\beta_8^\theta)$)	77%	77%	75%
unmarried women 1981–1987 ($= exp(\beta_7^\theta)$)	95%	97%	105%
unmarried women 1988–1995 ($= exp(\beta_7^\theta + \beta_{10}^\theta)$)	83%	84%	84%
married women 1981–1987 ($= exp(\beta_7^\theta + \beta_8^\theta + \beta_9^\theta)$)	125%	127%	148%
married women 1988–1995 ($= exp(\beta_7^\theta + \beta_8^\theta + \beta_9^\theta + \beta_{10}^\theta + \beta_{11}^\theta)$)	104%	98%	91%

The joint effect of gender, marital status and the calendar time relative to unmarried men is contained in Table 2. Married men show the shortest unemployment duration of all groups considered. Unmarried women, in contrast, experience about the same unemployment duration as unmarried men in the period 1981 to 1987. Yet, in the years 1988 to 1995, the unemployment duration of unmarried women is shorter, compared to the period before and compared to the duration of unmarried men. Married women in the years 1981 to 1987 are unemployed significantly longer than unmarried men. One possible explanation for the shortened unemployment duration of married as well as unmarried women is the reform of parental leave benefits which was introduced in Germany in 1986. Since then, the length of entitlement to parental leave benefits has been extended gradually (see Table 3 for an overview). This may have forced the women in motherhood to register less frequently as unemployed.

Table 3: Entitlement to parental leave benefits*

Year	1986	1988	1989	1990	1992
Entitlement	10 months	12 months	15 months	18 months	36 months

*(Source: Weber, 2004)

Citizenship Holding the influence of the other variables in the model constant, employees without German citizenship tend to be unemployed significantly longer than their German colleagues. The effect is stronger for the lower quantiles than for the higher ones.

Education Individuals with a completed apprenticeship exhibit significantly shorter unemployment duration than the reference category which is non-skilled workers. For those with a university degree, we observe an advantage in the lowest and in the highest quantiles only. For a more detailed analysis about the effect of education on unemployment duration using a duration model with unobserved heterogeneity see Lauer (2003).

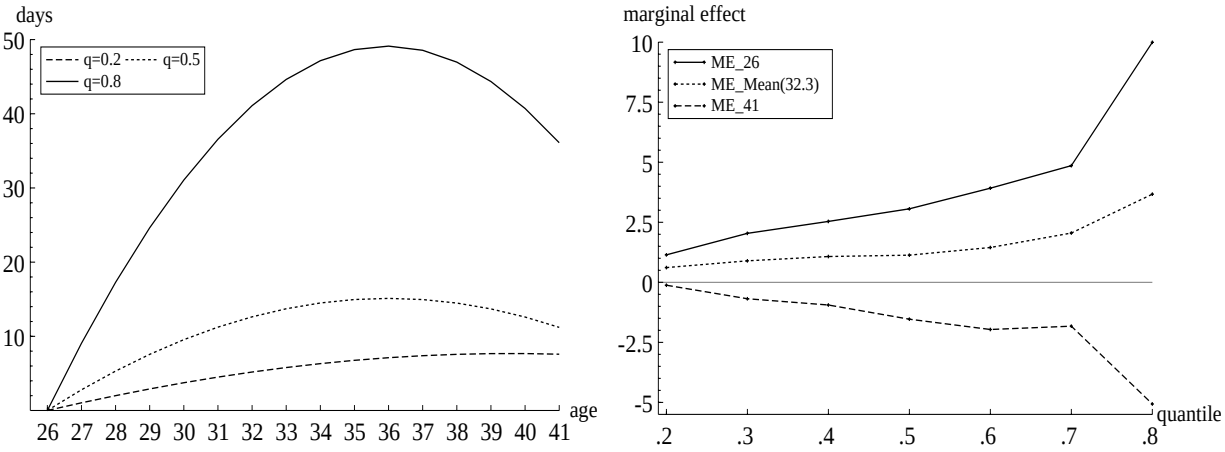
Table 4: Effect of education in 1992-1995 relative to no completed apprenticeship

Education	$\theta = 0.2$	$\theta = 0.5$	$\theta = 0.8$
Completed Apprenticeship ($= exp(\beta_{13}^{\theta})/exp(\beta_{15}^{\theta})$)	74%	74%	76%
University Degree ($= exp(\beta_{14}^{\theta})/exp(\beta_{15}^{\theta})$)	85%	89%	86%

The interaction "no apprenticeship *1992-1995" is observed significantly positive. Over the course of the years, completing an apprenticeship has become more important in particular during the mid nineties recession (see Table 4). This may also be due to the increasing globalization which caused many jobs for low-skilled workers to be transferred to countries with lower wage levels.

Age The regressor age enters the quantile regression model with a linear and a quadratic term and we found a concave functional relationship between age and unemployment duration. Figure 2 (a) contains the age effect (in days) relative to a 26-year old person on the unemployment duration. At the 0.8 quantile, for example, a 27-year old person is unemployed about 10 days longer than a 26-year old person.

As denoted earlier, the marginal effect of age on unemployment duration is defined as the derivative of the conditional quantile function with respect to age. In Figure 2 (b), the marginal effect of age on unemployment duration is evaluated for the minimum age (26 years), sample mean age (32.3 years) and maximum age (41 years) and for the sample means of all other regressors. Whereas the marginal effect of age on unemployment duration is positive for the younger unemployed, it is negative for older people.



(a) Effect of age relative to a 26-years old

(b) Estimated marginal effect of age

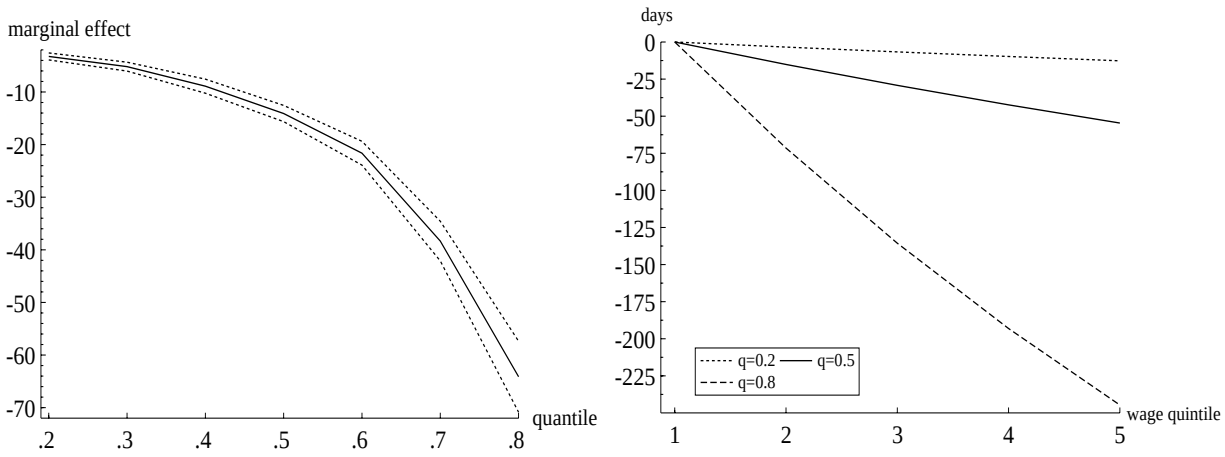
Figure 2: Age

4.3 Individual employment history

Wage quintile We included the nominal variable wage quintile, as the continuous wage variable contained in the data is censored. For each year, we computed the quintile of the earnings distribution of all full-time employed. We then determined in which quintile the unemployed was located when the unemployment spell started. In general, our observation is that the higher the previous wage, the shorter the duration of unemployment. This effect is increasing over the quantiles of the unemployment duration.

Figure 3(a) shows the marginal effect of the wage quintile in days evaluated at the sample mean of all regressors. We observe strong effects at the higher quantiles. This result reflects that the opportunity costs of not working are higher for individuals with higher pre-income earnings. Since the level of unemployment compensation in Germany is generally related to the magnitude of the former income[5], we do not obtain indications from this result that individuals with higher unemployment compensation transfers generally possess longer unemployment duration. This result contradicts some previous contributions (e.g. Steiner, 2001) which support the common hypothesis that the expected unemployment duration increases with the compensation level whereby it supports the findings in other contributions (e.g. Hujer and Schneider, 1995). However, our results may change if we take into account the results of Fitzenberger and Wilke (2004) that many elderly unemployed (with long-term employment history and relatively high earnings) are in fact early retired and they are not looking for a new job. The results of the other studies do not take this

[5]Unemployment assistance is also means tested.



(a) Estimated marginal effect of the wage quintile

(b) Effect of the wage quintile relative to the lowest wage quintile

Figure 3: Wage quintile

into account and therefore they may get the opposite results just by including the elderly. From the strongly decreasing marginal effect in Figure 3a) we can draw another interesting finding. Note that the reduction in unemployment compensation after the exhaustion of ALG is in many cases higher for individuals with higher pre-unemployment earnings. This is because individuals with very low pre-unemployment earnings usually do not exceed the level of social benefits from the very beginning of the unemployment duration. For this reason the exhaustion of ALG after 12 months can be considered as a treatment for particularly the individuals coming from the higher quantiles of the earnings distribution. When we compute the predicted duration 365 days at the sample means of the regressors, we obtain that this is in between quantiles 0.6 and 0.7. Interestingly, the marginal effect of the wage quintile sharply increases at these quantiles. The treatment of reducing the benefit levels after 12 months may therefore have an impact on the wage quintile coefficient for the higher quantiles. However, further investigations with data containing more information about the receipt of unemployment compensation would be highly interesting. This would allow us to investigate further whether the wage quintile coefficient would be more negative for lower quantiles in a world without ALG.

To make clear how important the level of the previous wage is, we computed the effect of a transition from the lowest wage quintile to a higher one (see Figure 3(b)). This effect is strongest at the 0.8 quantile: There, the difference in unemployment duration from the highest to the lowest wage quintile amounts to about 240 days. This implies that the share of extreme long term unemployment is much higher for individuals with low pre-unemployment

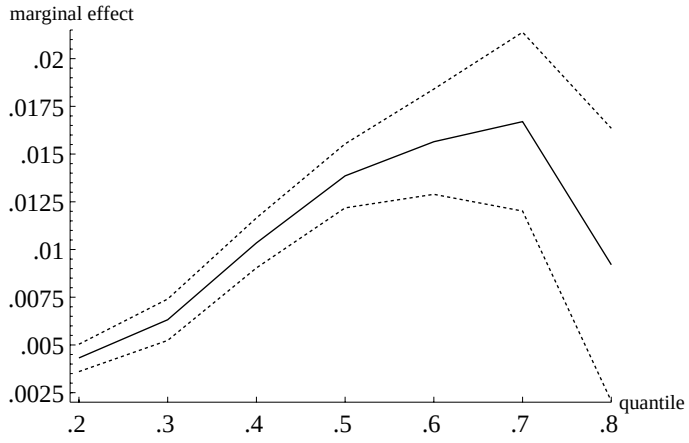


Figure 4: Estimated marginal effect of tenure (in days) with 90% bootstrap confidence bands

income.

Tenure Tenure is associated with a modest but significant increase in unemployment duration. This is more evident for the lower quantiles than for the higher ones.

Figure 4 shows the marginal effect of tenure on the duration (in days). This is the derivative of the conditional quantile with respect to tenure. It should be interpreted as the increase in unemployment duration (in days) which would keep an individual with an additional day of tenure at the same quantile. This marginal effect of tenure is highest at the 0.5 to 0.7 quantiles. We find plausible explanations for this observation: first, unemployed with a long foregoing employment duration may not be used to the situation of being unemployed and therefore there is a higher risk of dropping in long-term unemployment. Another explanation might be that wage expectations are too high due to a continuous wage increase in the former job. Since this reservation wage level is not easily reached, the unemployed waits for a long time for better job offers. A third explanation is that long-term employed enter unemployment for personal reasons (e.g. health problems).

Unemployment compensation within the last year Those who have received any form of unemployment compensation (ALG, ALHi, UHG) within the last year before becoming unemployed show significantly shorter periods of unemployment. The effect is stronger for the upper quantiles. If we compare this effect to tenure in the first twelve months of duration time we observe that the two variables balance out and therefore the tenure variable has a strong effect only on unemployed with long-term employment before unemployment.

Recall Employees who have had an unemployment spell before and had been re-employed by their previous employer (recall) also tend to be unemployed significantly shorter. Again, the effect is stronger for the upper quantiles. At the 0.8 quantile, the unemployment duration is only 41% ($= e^{-0.89}$) of that of people without recall. The strong effect of the recall variable is already investigated by Plaßmann (2002).

5 Summary

In this paper, the effect of various regressors on individual unemployment duration is analyzed using censored quantile regression. We have argued that quantile regression offers a constructive complement to existing statistical methods of duration analysis. On the one hand, the censored quantile regression estimator enables the accommodation of incomplete duration data. On the other hand, it is a more flexible approach than the conventional proportional hazard models in the sense that it allows the covariates to have different impacts at different points of the distribution. Our analysis suggests that the central assumption of the latter is violated for some of the regressors when the underlying model does not account for unobserved heterogeneity. Therefore, from this viewpoint quantile regression techniques seem more appropriate for the analysis of unemployment duration.

In contrast to most of the former studies on unemployment duration in Germany, our analysis is not based on the GSOEP and therefore possible disadvantages of survey data can be avoided. Instead, we used a subsample of the IAB-subsample (1981-1997) - regional file - which is register data containing information about employment and unemployment periods of socially insured employees and unemployed provided that any form of unemployment compensation is received. The analysis is restricted to unemployed persons aged 26 to 41. Most of the former studies have included older persons and therefore the effects of regressors on unemployment durations are likely to be confounded with the effects of the reform of the German unemployment compensation system which took place in the 1980s. In addition, early retirement on the cost of the unemployment insurance system was promoted by the German government during this period.

We find that the individual unemployment history had a stronger effect on the unemployment duration than sociodemographic variables and the macroeconomic situation. Individuals who had been unemployed before and who were recalled by their former employer exhibit significantly shorter unemployment duration. Long-term unemployment can be better explained by the individual employment history. Interestingly, a lot of working experience

without periods of unemployment increases the probability of long-term unemployment.

Although we do not have information about the level of unemployment compensation received, we find that the effect of the regressor "wage quintile" becomes much stronger at the higher quintiles of the unemployment duration distribution where the entitlement to unemployment benefits (ALG) has expired. However, further research is necessary on this issue.

Although the unemployment rate has doubled in the observed period, we only found relatively weak effects of the macroeconomic situation. Another interesting finding is that the unemployment duration of females has shortened during the period under consideration. This may be attributed to the introduction of parental leave benefits in 1986. In the 1980s, married females have had the longest unemployment duration.

Appendix

Table 5: Descriptive Statistics

Variable	Mean	Median	Std.Dev.	Minimum	Maximum
Unemployment Duration (days)	425.74	180	650.30	1	6206
Age	32.30	32	4.60	26	41
Tenure (days)	1032.54	543	1192.00	1	5843

Censored	yes	12.53%
	no	87.47%
Recall	yes	17.65%
	no	82.35%
Unemployment compensation within the last year	yes	42.00%
	no	58.00%
Gender	female	36.55%
	male	63.45%
Marital status	married	53.74%
	unmarried	46.26%
Citizenship	German	88.37%
	Other	11.63%
Education		
	unskilled	29.60%
	skilled	64.68%
	university degree	5.73%
Profession Group		
	agriculture	3.29%
	mining	0.26%
	production	45.34%
	technical professions	3.60%
	service professions	47.46%
	other	0.06%

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